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ABSTRACT

The effects on maladaptive behavior and test performance of stark versus enriched physical environments were examined with 16 severely and moderately retarded adults in a large residential institution. The relevant literature was reviewed and classified in four categories: cognitive development studies; studies of the effects of manipulated environmental variables on maladaptive behavior of the retarded; studies of environmental determinants of behavior in naturalistic settings; and studies of environmental variables affecting test performance. The eight male and eight female Ss were given a 20-minute standardized test in both a sparsely furnished room and an enriched, pleasantly furnished room while an observer recorded behaviors. Results suggested that physical decoration of institutional living areas, although welcome as a normalizing influence, may not be effective in significantly decreasing maladaptive behavior or increasing test performance. It was also found that Ss in the enriched setting appeared to engage in less self-stimulatory behavior. (JW)

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Enriching the Physical Environment:
Effects on Test Performance and Maladaptive Behavior

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The stark living environments of most large institutions for the mentally retarded have been pointed to as a likely cause of maladaptive behaviors. Much has been written about the negative effects of "institutional environments," and it has been suggested that enrichment or normalization of those environments may result in increased adaptive functioning and decreased levels of maladaptive behavior (McAndrew and Edgerton, 1964; Blatt, 1970).

Research on the effects of physical environment enrichment can be separated into four categories: 1) cognitive development studies, 2) experimental studies of the effects of manipulated environmental variables on a variety of maladaptive behavior of mentally retarded persons in controlled settings, 3) studies of environmental determinants of maladaptive behavior in large institutions and smaller community-based living settings, and 4) studies of environmental variables affecting test performance.

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Cognitive Development Studies. The positive effect of environment enrichment on the cognitive development of animals and human infants has been well documented. Rosenzweig and Bennett (1969) demonstrated that enriching the physical living environment of rats and providing them with learning and play opportunities resulted in an increase in brain weight and neurochemical efficiency.

In animal studies, deprivation has resulted in the loss of or failure to develop perceptual, social, and other skills (Scott, 1967; Menzel, Davenport, and Rogers, 1966; Wiesel and Hubel, 1963). Extra stimulation at an early age has produced less fearful, more curious animals (Denenberg, 1966; Forgas, 1954). Stimulus-impo- verished environments may also have a negative influence on human development, and enrichment of the environment may increase cognitive abilities. White (1971) has shown that visual stimulation in the form of colorful objects and crib ornaments such as mobiles may accelerate an infant's development of visually directed reaching in the first few months of life. It has been argued, though, that active manipulation of the environment and the responsiveness of the environment to the infant's behavior may be much more important than enrichment of the environment or the amount of stimulation provided. (Watson, 1971).

Maladaptive Behaviors in Controlled Settings. Several investigators have experimentally studied the effects of physical and social environment enrichment on various categories of behavior of institutionalized, profoundly retarded persons. Davenport and Berkson (1963) looked at the effects of novel objects on stereotyped behavior of retarded children and adults. Stereotypy decreased when new objects (toys) were present. These investigators also found, however, that stereotyped behavior increased in a novel restricted environment, compared to behavior in a familiar institutional environment.

Hollis (1965) systematically observed retarded children in an empty room (stark environment), with a variety of objects present (enriched environment), and under three social conditions

(adult, peers, and inanimate "surrogate mother"). Stereotypic behavior, both simple rocking and more complex stereotypic behavior, was most frequent in the empty room condition; complex stereotypies were least frequent when novel objects were present in the environment.

Horner (1980) observed five profoundly retarded females for 60 days in a naturalistic setting (institutional dayroom) under conditions of 1) stark environment, 2) enriched environment (manipulable toys added), and 3) enriched environment plus differential reinforcement of adaptive behavior. Maladaptive self-directed behavior (including stereotypies and self-abusive behavior) averaged 59% in the stark condition, 30% in the enriched environment, and 16% in the enriched environment with differential reinforcement. Adult-directed and peer-directed maladaptive behavior showed no significant differences across conditions.

These experimental studies of mentally retarded persons suggest the importance of social and physical environment variables on stereotypic behavior; an effect of physical enrichment was not demonstrated on other classes of maladaptive behavior. It should be noted that physical enrichment in these studies involved objects which were manipulated by the subjects, rather than simple decoration.

Environmental Determinants of Behavior in Naturalistic Settings.

Studies of factors associated with maladaptive behavior in community-based homes have also pointed to the importance of social environmental factors and have generally not found significant effects of physical aspects of the community living environments. Willer and Intagliata (1981) found fewer behavior problems in family-care homes

and group homes where expression of feelings (a social variable) was encouraged; physical characteristics such as size of residence were not significantly correlated with amount of behavior problems. Eyman et al. (1981) found no difference over a three-year period in maladaptive behavior of residents of community-based living environments and large institutions (presumably, less enriched), controlling for initial levels of behavior.

Landesman-Dwyer (1981) reviewed the literature on variables affecting "success" of community residential programs. She reported that size of residence was not a significant factor in staff or resident behavior, countering the widely held assumption that smaller settings are better. Other physical environment variables were not discussed.

These findings throw into question the assumption that physically more attractive, enriched, or normalized environments have a beneficial effect on maladaptive behavior. However, studies of variables most relevant to the concept of an enriched environment have not been done.

Environment Enrichment and Intelligence Test Performance.

It is well documented that reinforcement of correct responding by the examiner results in increased test performance by institutionalized retarded adults (Breuning and Davis, 1981). It has also been suggested that enrichment of the physical environment may result in increased test scores for normal or above normal children. We were unable to find any literature on physical environment and performance of mentally retarded persons on cognitive tests.

Hypotheses. The literature on the negative effects of stark environments led us to question whether properties of the physical environment exerted an effect on behavior, through a direct perceptual stimulatory mechanism or perhaps by means of established associations with stark environments.

It was hypothesized that subjects would exhibit more maladaptive behavior in a physically stark environment than in an enriched one. It was also hypothesized that the latency for noncompliant behavior under restrictive instructions would be lower in the stark environment.

To the extent that a more normalized environment contributes to relaxation and more appropriate attending behavior in the test setting, one would expect that a subject could concentrate on the task better and improve test performance. We hypothesized, then, that our subjects would show increased test performance when the environment was enriched.

Method

Subjects. Subjects were 16 severely and moderately retarded adults living in a large residential institution in Laurel, Maryland. Their IQs ranged from 25 to 49, and their ages from 19 to 42 years. Eight subjects were females and eight were males. All subjects were selected for high frequency of disruptive and aggressive behavior, which was documented in cottage records. All subjects lived in living areas which could be considered to be physically stark environments.

Setting and Conditions. The experimental sessions took place in two identical 7½' by 11½' rooms in a cottage at the institution.

Each room had a one-way mirror and a screened window. In both experimental conditions, there were a table, two chairs, a small cabinet, and an overhead light. In the "stark environment" condition, the chairs were of molded plastic, and there were no other objects in the room except for testing materials. In the "enriched environment" condition, the chairs were padded, and the following objects were placed in the room: a large Oriental rug, an additional small table, tablecloths covering both tables and the cabinet, two large framed paintings (landscapes), several smaller pictures and posters, a hanging plant and two other potted plants, a table lamp, and a few decorative knickknacks placed on one of the tables. Soft jazz music could be heard from a tape recorder in a nearby room. No toys or other manipulable objects were placed in the room.

Design and Procedure. Males and females were randomly assigned to the two experimental conditions so that 4 males and 4 females were tested in the enriched room, then in the stark room. The other 4 males and 4 females were tested in the reverse order. The two experimenters, institutional psychologists, each tested 8 subjects; each experimenter was randomly assigned to test 4 subjects in the enriched room first and 4 in the stark room first. Testing for each subject occurred on successive days at the same time of day, usually in the morning, although conflicts with program schedules made it necessary to test a few subjects in the afternoon. Testing was completed in three and a half weeks.

One of the experimenters met the subject and escorted him or her to the testing room, which was decorated according to the scheduled environmental condition. The other experimenter was

seated in the adjacent room and observed the test session through the one-way mirror. The subject and tester sat down across from each other at the table, and standard test administration procedures were followed. If subjects talked about unrelated topics, asked to go to the bathroom, or engaged in disruptive behavior, the tester urged them to continue with the test. During this time, the observer coded the subjects' behavior every 15 seconds as attending to task and appropriate, out-of-seat, seated but not attending, inappropriate verbal behavior, self-stimulatory behavior, or major behavior problems (tantrum, property destruction, or aggression).

Testing was discontinued after 20 minutes. The tester then instructed the subject to remain seated and quiet while he scored the subject's test responses. The observer again coded the subject's behavior for two minutes and recorded the latency of behaviors which did not comply with the tester's instructions. Self-stimulatory behavior was not considered non-compliant or disruptive in this two-minute period. The subject was then dismissed and returned to his or her living area. This same procedure was followed on both test days.

Test Materials. Wechsler vocabulary and information sub-scales and the Peabody Picture Vocabulary Test were administered. The Wechsler similarities sub-scale was administered to some subjects to complete the 20-minute test period, but it was not scored. Sub-scales from the WPPSI and WISC were combined to ensure a sufficient number of items to span the 20-minute period. All tests were divided into split-half sub-tests. The two split-halves were counterbalanced across order of test and type of environment. Standard test procedures were used, so that five consecutive failures on the Wechsler tests

and six failures in eight successive trials on the Peabody terminated that test. The order of testing for all subjects was Wechsler vocabulary, Wechsler information, and Peabody; Wechsler similarities followed, if necessary to fill up the 20 minute session.

Results

Reliability. Inter-observer reliability for coding of behavior problems was assessed in a single session with both experimenters observing a test session conducted by a third person. Each observer scored each 15-second period as "appropriate behavior" or as one or more of the problem behaviors. Disagreements were defined as the differences in the totals for each behavior category. Reliability was computed by dividing the total number of behavior judgments minus the number of disagreements by the total number of judgments. Inter-observer reliability was .88.

General Considerations. There were no significant differences in test performance or maladaptive behavior between the first and second test sessions. Similarly, there were no experimenter effects or sex differences. Thus, data were combined for analysis of the effects of the two environmental conditions.

Maladaptive Behavior. The frequencies of appropriate behavior and four categories of maladaptive behavior were measured by the average number of 15-second periods in which the behaviors occurred during a 20-minute test session. There were no occurrences of the category, "major behavior problems." Appropriate behavior was not counted for a 15-second period if either out-of-seat, seated but not attending, or inappropriate verbal behaviors occurred

during that period. Self-stimulatory and appropriate task behavior were not considered mutually exclusive. The frequencies of the five behavior categories are shown in Figure 1.

There was very little difference between the frequencies of the behaviors in the enriched and stark conditions, except for a greater number of "seated but not attending" behaviors in the stark condition (5.9 periods per session in the stark condition and 3.5 periods in the enriched condition). None of the differences approached statistical significance.

Subjects were further divided into two groups, depending on their level of experience with enriched environments. "High experience" subjects had frequent home visits and/or participated in programs away from the institution where they were exposed to an environment more stimulating than that of their institutional living area. "Low experience" subjects did not have home visits or outside day programs. There were nine high experience subjects and seven low experience subjects in the sample.

Frequencies of the behavior categories for high and low experience subjects are presented in Figure 2. There were no significant main effects of experience. It is noteworthy, however that 25 of the 26 periods of out-of-seat behavior are accounted for by the seven low experience subjects. That difference did not reach statistical significance, however ($t(df = 14) = 1.77, p = .10$).

The interactions between level of experience and environmental condition were examined by a repeated measures analysis of variance. High experience subjects had more self-stimulatory behavior

in the stark setting (8.8 periods per session vs. 6.2 in the enriched setting), and low experience subjects manifested the opposite relationship (4.9 per session in the stark setting and 9.3 in the enriched setting). This interaction did not reach statistical significance, however, $F(1, 14) = 2.94, p = .10$.

The period of time elapsed between the beginning of the two-minute "quiet period" after testing had been completed and the first incidence of a noncompliant behavior (talking, getting out of the chair, grabbing test materials) was recorded. In 17 of the 36 test sessions, there was no noncompliant behavior in this period, and the latency was recorded as 120 seconds (the length of the period). The average latency was shorter in the enriched condition (77.0 seconds) than in the stark condition (89.6 seconds), suggesting more noncompliance in the enriched setting. This difference was not statistically significant.

Test Data. Performance on the split halves of the Peabody Picture Vocabulary Test and the Wechsler information sub-scale was measured by summing the total number of test items passed. Performance on the Wechsler vocabulary sub-scale was scored according to the standard scoring criteria. Average scores in the enriched and stark conditions are shown in Figure 3. Performance was better for all tests in the enriched environment, but none of these differences approached statistical significance.

High experience subjects scored higher than low experience subjects on all tests. High experience subjects averaged 36.9, 13.1, and 8.9 on the Peabody, vocabulary, and information scales, respectively, compared to 30.3, 10.9, and 7.4 for low experience

subjects. None of these differences approached statistical significance, and there were no interactions with environmental condition.

Discussion

The hypothesis that enriching the physical setting would have an immediate positive effect on maladaptive behavior was not supported. Similarly, hypothesized significant improvement in test performance was not observed. These results suggest that responsivity of the environment to behavior may be a critical factor in previously observed positive effects of environmental enrichment (cf. Watson, 1971; Horner, 1980). Physical decoration of institutional and community-based living areas, although welcome as a normalizing influence, may not be an effective strategy for decreasing maladaptive behavior; resources are better used to ensure appropriate resident-staff interactions (cf. Horner) and to provide activities which require active participation.

Some small, nonsignificant effects were obtained. The higher scores on all three tests in the enriched environment, together with improved attending behavior, suggest a positive effect of environment enrichment on concentration on the task. The test situation may have been so highly controlled by the experimenter, who gave his full attention to subjects and continuously provided verbal instructions guiding behavior, that effects of other environmental variables were overshadowed. However, during the two-minute "quiet period" after testing was completed, there was no observed effect of environmental condition on behavior; in fact, the difference in latency of noncompliance was in the opposite

direction from what was hypothesized.

The other marginal effect of interest is the finding at the .1 significance level that subjects with experience in enriched settings had less self-stimulatory behavior in the enriched setting, while those without such experience had less in the stark setting, a setting more similar to their living environment. This finding of less stereotypic behavior in familiar settings is similar to Davenport and Berkson's (1963) finding that profoundly retarded subjects exhibit more stereotypy in novel restricted settings than in familiar ones. It could be that an unfamiliar setting is seen as threatening and that stereotypic responses are produced as a learned response to perceived threat.

There are several factors which may have contributed to the failure to obtain significant effects of environmental enrichment in this study (i.e., a Type 2 error). First, the test situation was strongly controlled by the tester, as mentioned above. Furthermore, a twenty-minute session may not have been long enough to adequately assess any effects. The Horner study, which found effects of toys in the environment, used a time-sampling procedure which spanned more than two months. Second, the novelty of a "homey" atmosphere in an institutional setting may have influenced the target behaviors in a negative way. Third, particular aspects of the "enrichment" may have been deleterious, and other enrichment schemes might be beneficial. Finally, previous studies have used profoundly retarded subjects; we used severely and moderately retarded subjects. It is possible that high func-

tioning persons, perhaps more readily influenced by and alert to social factors, are less strongly influenced by inanimate features of the environment than are profoundly retarded persons.

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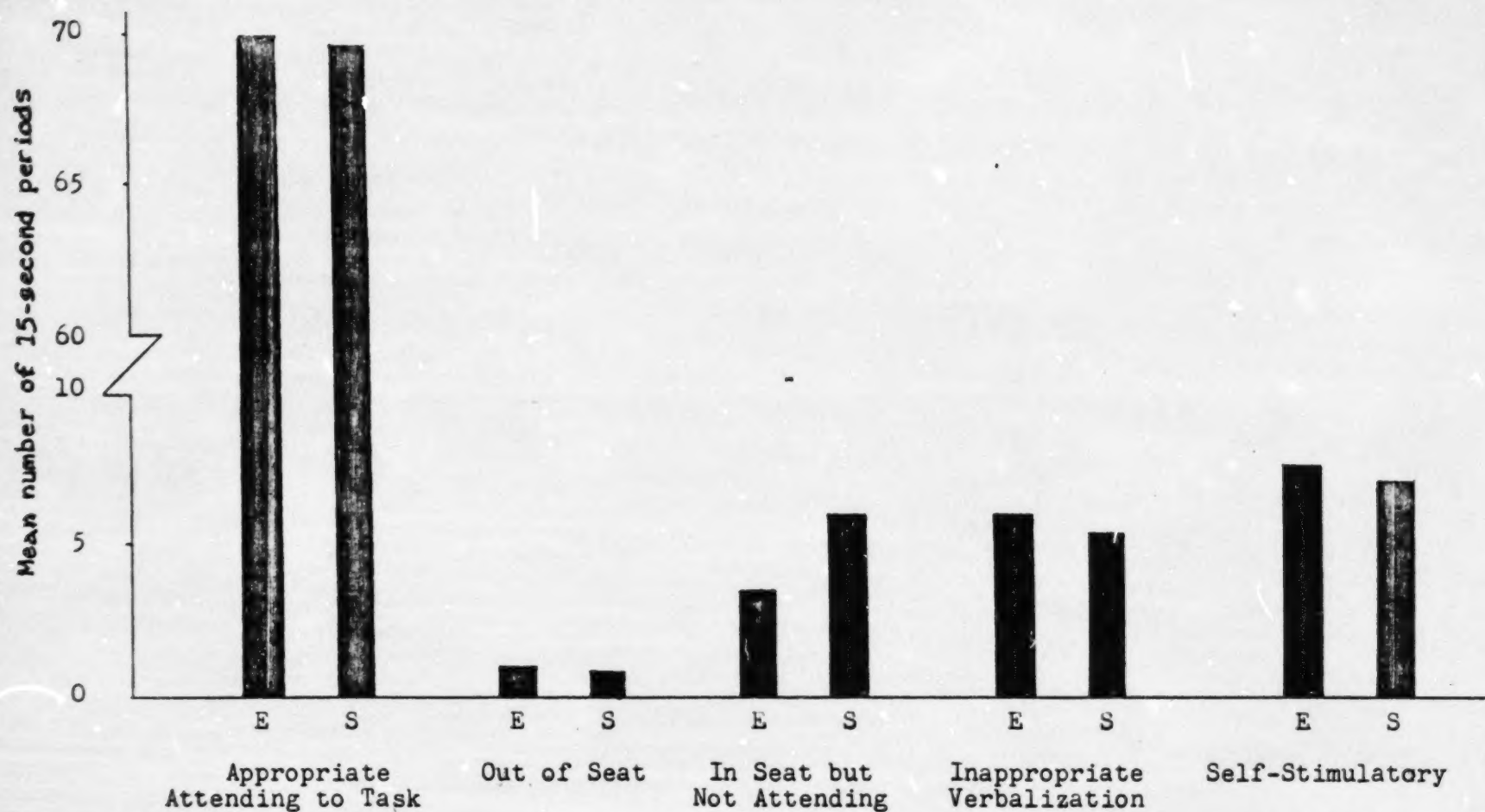


Figure 1. Mean number of 15-second periods during which target behaviors occurred in enriched (E) and stark (S) test settings.

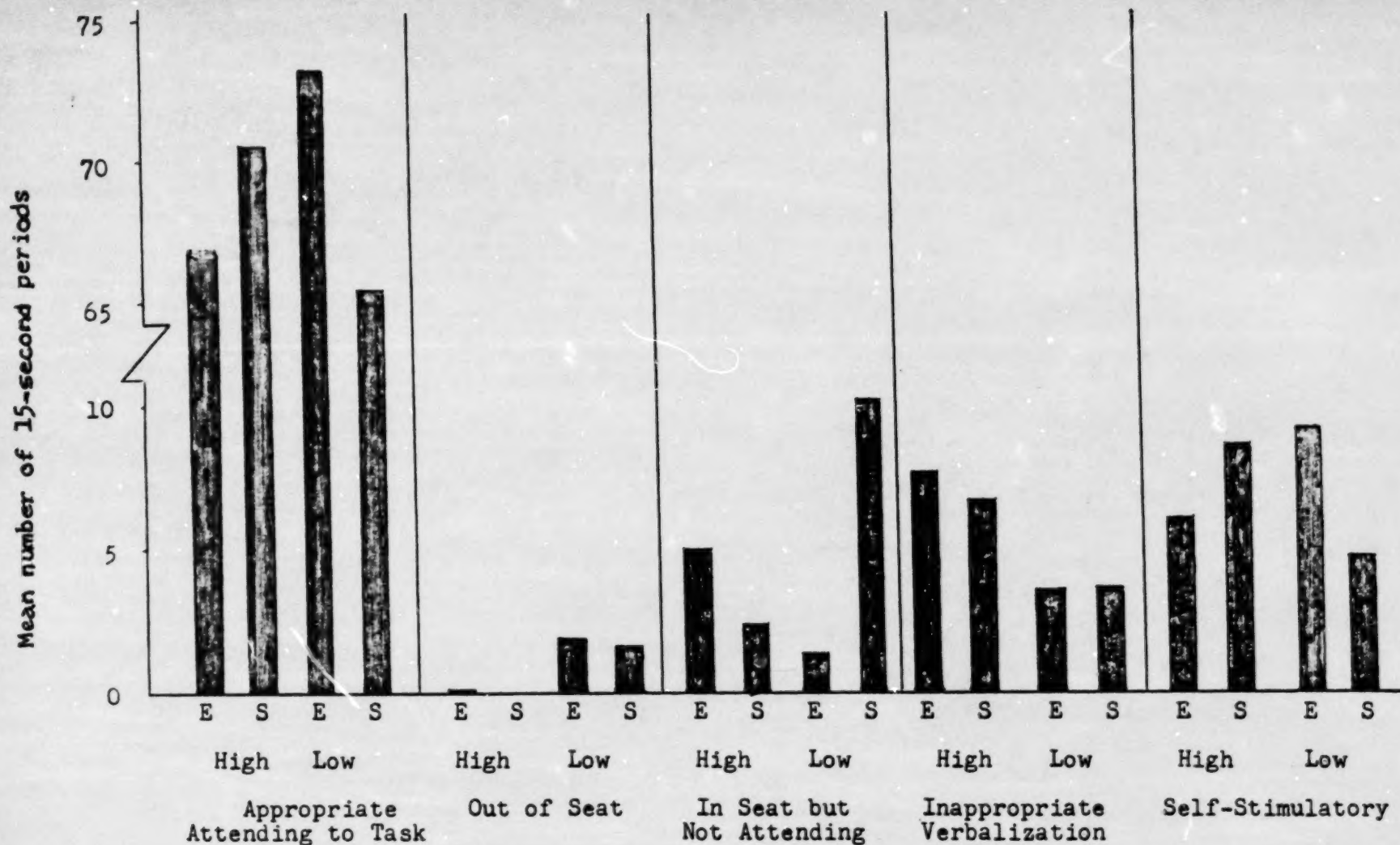


Figure 2. Mean number of 15-second periods during which target behaviors occurred in enriched settings (E) and stark settings (S) for subjects with high levels of experience in enriched settings ($N = 9$) and subjects with low levels of experience ($N = 7$).

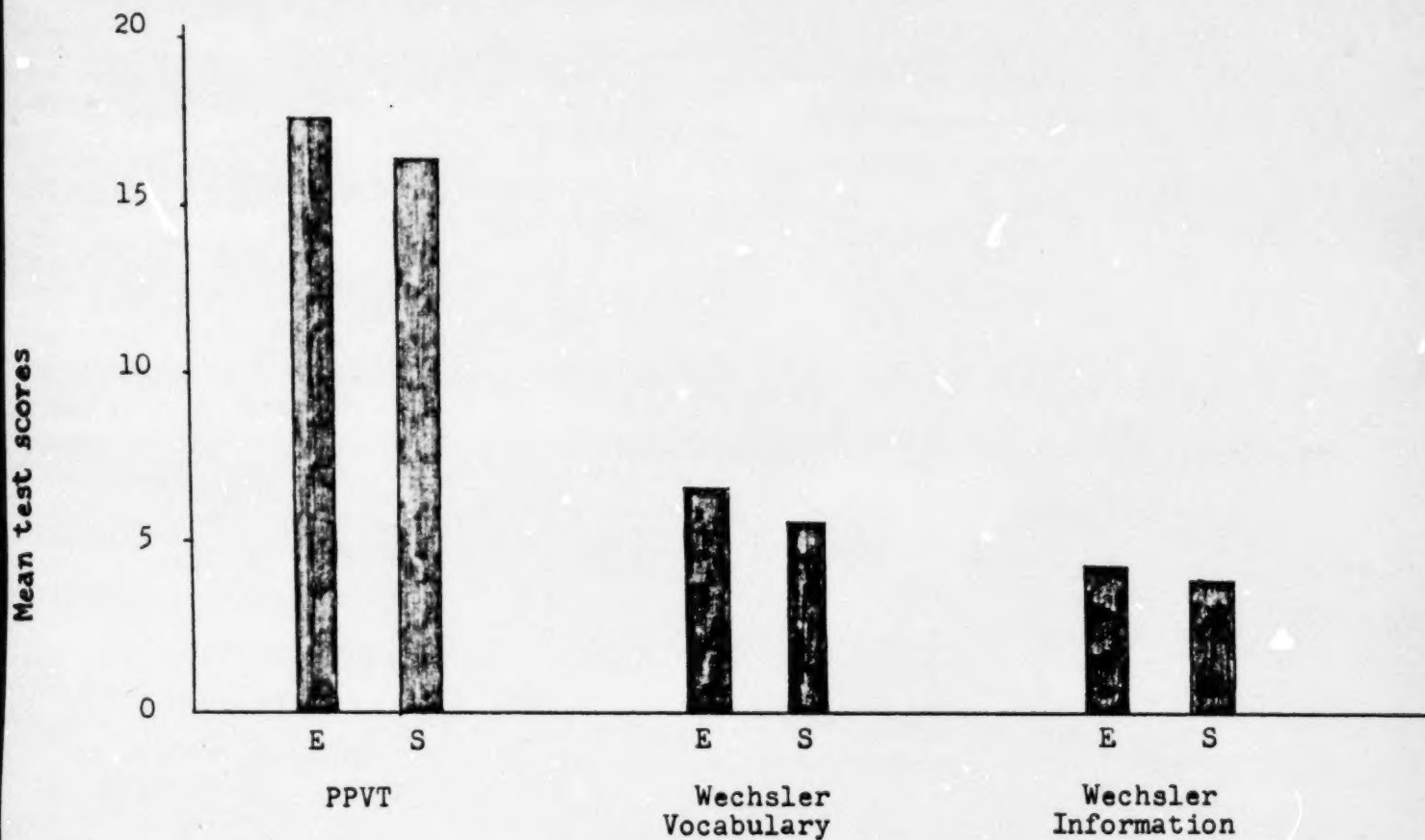


Figure 3. Mean test scores in enriched (E) and stark (S) settings.